National Park Service
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Natural Resource Program Center

Technical Guidance on Assessing Impacts to Air Quality in NEPA and Planning Documents

Natural Resource Report NPS/NRPC/ARD/NRR—2010/271





ON THE COVER

Hiker photographing distant vistas in the Needles District at Canyonlands National Park, Utah.
Credit: National Park Service.

ON THIS PAGE

Good (top) and poor (bottom) visibility at Yosemite National Park, California.
Credit: National Park Service.

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Natural Resource Program Center
Air Resources Division
PO Box 25287
Denver, Colorado 80225

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All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner. This technical guidance has undergone review by the NPS Air Resources Division, the Environmental Quality Division, and the Natural Resource Program Center's Planning Technical Advisory Group, along with the Department of the Interior Solicitor's Office. It consists of technical air quality information subsequent to, and consistent with, the intentions and purpose of the Federal Land Managers' Air Quality Related Values Work Group Report (commonly referred to as FLAG 2010 [USFS, NPS, and FWS 2010]), which underwent formal public notification (Federal Register Notice) and review.

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1. Purpose

This paper provides an overview of approaches to assess impacts to air quality and resources affected by air pollution. It specifically applies to projects assessed under the National Environmental Policy Act (NEPA) and other planning initiatives affecting the National Park System. This technical air quality guidance for park staff, and technical specialists is intended for use in developing initial air pollution emissions estimates, determining the appropriate level of air quality analysis, assessing whether air pollution impacts are likely, and describing the degree and severity of those impacts to resources in National Park System units. It identifies technical air quality modeling and analysis tools and information resources that are available to conduct air quality impact assessments on park resources. This guidance is also intended to provide National Park Service (NPS) managers with air quality information for consideration when assessing compliance with the no-impairment mandate of the NPS Organic Act (NPS Management Policies 2006; Section 1.4.5).

This guidance was developed to facilitate assessment of air pollution impacts to natural resources on NPS lands. While approval of projects generating air pollutants within National Park System boundaries is within the purview of the NPS, it is acknowledged that many of the pollution sources affecting parks are located outside park boundaries. For these projects NPS staff can work with other agencies, industries, or groups with project approval oversight to communicate impact and impairment concerns.

While this document provides guidance on determining impairment under the NPS Organic Act, it does not establish a "bright line" for the amount of air pollution or air quality impacts which are acceptable or unacceptable. It is clearly inappropriate to consider all actions that fail to rise to the level of impairment as desirable or even acceptable. National Park System units are not "managed to" the threshold of being impaired. On the contrary, they are managed with the intent of being fully functional landscapes, worthy of being considered "special places" to the American people.

This document is subject to revision in the future as additional planning guidance is developed within NPS. Material in this technical guidance has been adapted from an earlier document, *Interim Technical Guidance on Assessing Impacts and Impairments to Natural Resources* (NPS 2003). The 2003 interim guidance document also encompasses other natural resources of concern (e.g., biological, geologic, watersheds, lightscapes, soundscapes, and ecosystems).

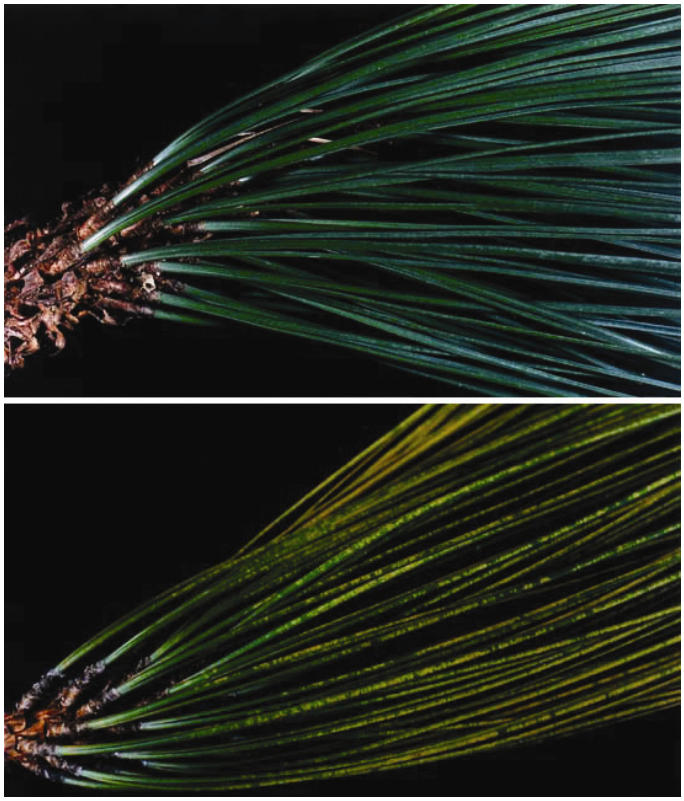


Photo of healthy (top) and ozone-injured (bottom) ponderosa pine needles from Southwest U.S.
Credit: National Park Service.

The policies and recommendations contained within this document are only intended to facilitate the decision making process for evaluating the severity of air quality impacts from internal and external activities, and improve the internal air resources management of the NPS. These policies and recommendations are not intended to, and do not, create any right or benefit, substantive or procedural, enforceable at law or equity by a party against the United States, its departments, agencies, instrumentalities or entities, its officers or employees, or any other person.

2. Legal Framework for Air Quality Assessment

2.1. NPS Organic Act and Wilderness Act

The National Park Service Organic Act of 1916 states that the NPS:

> [S]hall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations hereinafter specified … by such means and measures as conform to the fundamental purpose of the said parks, monuments, and reservations, which purpose is to *conserve* the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them *unimpaired* for the enjoyment of future generations (16 U.S.C. §1; italics added).

Congress reaffirmed this mandate in 1978 when it directed the following:

> The authorization of activities shall be construed and the protection, management, and administration of these areas shall be conducted in light of the high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress (Act amending the Act of October 2, 1968 [commonly called Redwoods Act], March 27, 1978, P.L. 95–250, 92 Stat. 163, 16 USC §§1a–1, 79a–q).

The no-impairment mandate of the Organic Act is one of many legal requirements managers must consider and comply with when authorizing activities in parks. In some cases, requirements of air quality or other environmental laws and regulations might prohibit certain impacts on natural resources or values, irrespective of whether NPS managers would consider the impacts to rise to the level of "impairment." In other cases, impacts technically allowed by law might be prohibited in a park because they would be considered by NPS managers to be an impairment of park resources. Generally, the most stringent test should be applied prior to approving an activity.

The Wilderness Act of 1964 defines wilderness as:

> [A]n area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain … an area of undeveloped Federal Land retaining its primeval character and influence … which is protected and managed so as to preserve its natural conditions (16 U.S.C. 1131[c]).

In many cases, the specific language of the Wilderness Act may prohibit activities before an impairment determination must be made, thereby making an impairment decision unnecessary. In other cases, the Wilderness Act may provide supporting legal context for the impact assessment or impairment decision.

In addition to avoiding impairment, NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adverse impacts on park resources and values. However, the laws do give NPS the management discretion to allow certain impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, so long as the impact does not constitute impairment of the affected resources and values.



Wet deposition monitoring at Acadia National Park, Maine.
Credit: National Park Service.

2.2. Clean Air Act

2.2.1. National Ambient Air Quality Standards (NAAQS)

NPS air resource management policy has been developed in conjunction with requirements in the Clean Air Act (CAA) and the Environmental Protection Agency's (EPA's) regulations. The level of protection afforded some park resources and values by the CAA may be the determining factor when deciding whether air quality impacts are acceptable. Air pollution sources within park boundaries, must, by law, comply with all federal, state, and local regulations to the same extent as other entities. Air pollution sources outside park boundaries are also subject to varying federal, state, and local regulations depending upon land ownership and the type and size of pollution source. The CAA established National Ambient Air Quality Standards (NAAQS) to protect the public health and welfare from air pollution. Mitigation measures would likely be required under the CAA if emissions from an activity caused or

contributed to a NAAQS violation. This issue is discussed further under the "conformity requirements" section below.

The NAAQS describe thresholds for monitored air chemistry concentrations of six "criteria pollutants:" nitrogen dioxide (NO_2); sulfur dioxide (SO_2); carbon monoxide (CO); lead (Pb); ozone (O_3); and particulate matter (PM_{10} and $PM_{2.5}$). Threshold concentrations for these pollutants designed to protect human health are called "primary standards" and are intended to protect human health rather than natural resources (see Table 3 for a link to the NAAQS). EPA has also established "secondary" NAAQS to protect public welfare, including ecosystems. However, in most cases the secondary NAAQS are identical to the primary NAAQS and are not protective of sensitive ecosystems. EPA is currently reviewing and revising secondary NAAQS to provide appropriate protection to natural resources. Therefore, in addition to comparing air quality monitored or modeled values to the NAAQS, NEPA analyses for National Park System units will involve specific natural resource impacts analyses, as described in Section 4.4.

2.2.2. Clean Air Act Conformity Requirements for Nonattainment Areas

Areas of the country that do not meet the NAAQS for any pollutant are designated as "nonattainment areas." Areas that were once designated nonattainment, but are now achieving the NAAQS are termed "maintenance areas." Areas which have air pollution levels below the NAAQS are termed "attainment areas." In nonattainment areas, states must develop plans to reduce emissions and bring the area back into attainment of the NAAQS. There are stringent requirements for activities conducted by federal agencies in nonattainment and maintenance areas, to ensure that proposed pollution increases from new activities will not impede a state's ability to achieve the NAAQS in the future. Therefore, when parks are assessing project emissions for potential impacts, it is important for a park to first determine whether it is located in a nonattainment or maintenance area.

Parks located in areas that exceed the NAAQS (nonattainment areas) or whose resources are already being adversely affected by current ambient air quality levels require a greater degree of consideration and scrutiny when management actions are considered by NPS managers.

Section 176 of the CAA states:

> No department, agency, or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license or permit, or approve, any activity which does not conform to an [State] implementation plan … [T]he assurance of conformity to such a plan shall be an affirmative responsibility of the head of such department, agency or instrumentality.

In making decisions regarding activities or projects within a designated nonattainment area, park managers should discuss their plans with the appropriate state air pollution control agency to determine the applicability of conformity requirements.

2.2.3. Prevention of Significant Deterioration (PSD) Program

The CAA also established the Prevention of Significant Deterioration (PSD) of Air Quality program to protect the air in relatively clean areas. One purpose of the PSD program is to protect public health and welfare, including natural resources, from adverse effects that might occur even though NAAQS are not violated. Another purpose is to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic or historic value (42 U.S.C. 7401 et seq.). The PSD program includes a classification approach for controlling air pollution. Class I areas are afforded the greatest degree of air quality protection. Very little deterioration of air quality is allowed in these areas. Class I areas include international parks, national wilderness areas and national memorial parks in excess of 5,000 acres, and national parks in excess of 6,000 acres that were in existence as of August 7, 1977, when the CAA was amended. Currently, there are 48 areas in the National Park System designated as Class I. NPS areas that are not designated Class I are Class II, and the CAA allows only moderate air quality deterioration in these areas. However, pollution increases causing a violation of any of the NAAQS are not permissible in Class I or Class II areas. The PSD regulatory program generally consists of permitting and planning requirements to limit air quality deterioration and to prevent adverse impacts on Air Quality Related Values in Class I areas. The PSD program focuses primarily on large stationary sources of air pollution which would be located outside of park boundaries.

Under the PSD program, the park superintendent and the assistant secretary for Fish and Wildlife and Parks (the Federal Land Manager (FLM) for the U.S. Department of the Interior) have an affirmative responsibility to protect visibility and all other Class I area Air Quality Related Values from the adverse effects of air pollution. A new stationary pollution source proposing to locate near a Class I area must apply for a PSD permit from the appropriate regulatory agency, most often the state. The park superintendent, with technical assistance from the NPS Air Resources Division, then reviews the permit proposal for potential adverse impacts to park resources and provides comments to the permitting authority regarding permit conditions and approval of air pollution emissions from that source. Given the CAA goal and NPS resource protection objectives, the NPS may object to permits being issued for construction of new pollution sources outside park boundaries if these sources will contribute to adverse impacts within parks.

Regardless of classification for PSD permit review purposes into Class I or Class II areas, all parks enjoy the same level of Organic Act protection, and the impact levels for NEPA project review listed below should be applied consistently regardless of Class I or Class II area designation.

2.2.4. Protection of Visibility

Beyond the NAAQS and PSD programs, the CAA established a national goal of preventing any future, and remedying any existing, human-made visibility impairment

in Class I areas. "Visibility impairment" under the CAA visibility protection regulations is defined as "any humanly perceptible change in visibility." Here it is important to note that "visibility impairment" carries a specific regulatory meaning which does not necessarily correspond to the meaning of impairment under the Organic Act. While the Clean Air Act has a very low threshold for "visibility impairment" (*any* change), additional considerations come into play in determining whether the impact is adverse. EPA's visibility protection regulations define an adverse impact on visibility as:

> visibility impairment which interferes with the management, protection, preservation, or enjoyment of the visitor's visual experience of the Federal Class I area. This determination must be made on a case-by-case basis taking into account the geographic extent, intensity, duration, frequency and time of visibility impairments, and how these factors correlate with (1) times of visitor use of the Federal Class I area, and (2) the frequency and timing of natural conditions that reduce visibility. This term does not include effects on integral vistas (40 C.F.R. 51.301).

Therefore, the CAA "visibility impairment" definition may be considered by some to be more stringent than the impairment prohibited by the Organic Act. However, when "visibility impairment" interferes with the management, protection, preservation, or enjoyment of visitor's visual experience in any park unit, it may constitute an adverse impact that is unacceptable under the Organic Act.

All National Park System units experience "visibility impairment" under the CAA definition. Recognizing that visibility degradation occurring in parks has resulted from the cumulative effect of numerous sources, large and small, nearby and far away, both the NPS and EPA's regional haze programs focus on sources that exceed certain impact thresholds (e.g., 5% change in extinction constitutes a significant contribution to visibility impairment; 10% change constitutes visibility impairment). These criteria are also useful when assessing impacts from projects, plans, and activities in NEPA documents.

In 1999, EPA finalized the regional haze regulations which require states to develop plans for making reasonable progress toward eliminating visibility impairment in Class I areas, including strategies for steadily reducing emissions along a 60-year timeframe leading to natural conditions. Through these collaborative regional and state planning processes, park managers can ensure that park emissions are accounted for in plans now being developed and that activities inside parks do not compromise or delay progress toward eliminating visibility impairment.

2.2.5. Federal, State, and Local Pollution Emissions Requirements and Measures

In addition to the legal requirements discussed above, state and local regulatory agencies may have source-specific emission standards or mandated management practices or control measures that park managers should be aware of.

3. Management Framework

3.1. NPS Management Policies

Under the NPS Management Policies, the NPS will: "seek to perpetuate the best possible air quality in parks to: (1) preserve natural resources and systems; (2) preserve cultural resources; and (3) sustain visitor enjoyment, human health, and scenic vistas" (NPS Management Policies 2006; Section 4.7.1). The NPS Management Policies further state that the NPS will assume an aggressive role in promoting and pursuing measures to protect Air Quality Related Values from the adverse impacts of air pollution. While Air Quality Related Values (AQRVs) is a term originating from the Clean Air Act (as described above), it is often used by NPS generally to refer to all resources that may be affected by air pollutants. In cases of doubt as to the impacts of existing or potential air pollution on park resources, the NPS "will err on the side of protecting air quality and related values for future generations" (NPS Management Policies 2006; Section 4.7.1).

Note that the Organic Act and Management Policies apply equally to all NPS-managed areas, regardless of CAA designation. Therefore, the NPS will actively protect resources at Class II areas as well as Class I designated units, including using similar analysis techniques and criteria for evaluating effects to AQRVs in all National Park System units. Furthermore, the NPS Organic Act and Management Policies provide additional protection from that afforded by the CAA's NAAQS alone because NPS has documented that specific park AQRVs can be adversely affected at levels below the NAAQS or by pollutants for which no NAAQS exist.

Many projects and sources of air pollution affecting air quality within a park originate outside park boundaries. NPS policies direct park superintendents and other managers to actively participate in external planning and regulatory processes that may adversely affect the park resources and to seek to mitigate those impacts to the extent possible. *NPS Management Policies for External NEPA Review*, Chapter 1 states:

> 1.4.5. *What Constitutes Impairment of Park Resources and Values*
>
> Impairment may also result from sources or activities outside the park. This will be addressed consistent with sections 1.6 and 1.7 Cooperative Conservation and Civic Engagement.
>
> 1.6. *Cooperative Conservation Beyond Park Boundaries*
>
> Cooperative conservation beyond park boundaries is necessary as the NPS strives to fulfill its mandate to preserve the natural and cultural resources of parks unimpaired for future generations. Ecological processes cross park boundaries, and park boundaries may not incorporate all of the natural resources, cultural sites, and scenic vistas that relate to park resources or the quality of the visitor experience. Therefore, activities proposed for adjacent lands may significantly affect park programs, resources, and values. Such local and regional cooperation may involve other federal agencies; tribal, state, and local governments.
>
> The Service will use all available tools to protect park resources and values from unacceptable impacts. The Service will also seek to advance opportunities for conservation partnerships. Superintendents will monitor land use proposals, changes to adjacent lands, and external activities for their potential impacts on park resources and values. It is appropriate for superintendents to engage constructively with the broader community in the same way that any good neighbor would. Superintendents will encourage compatible adjacent land uses and seek to avoid and mitigate potential adverse impacts on park resources and values by actively participating in the planning and regulatory processes of other federal agencies and tribal, state, and local governments having jurisdiction over property affecting, or affected by, the park. If a decision is made or is imminent that will result in unacceptable impacts on park resources, superintendents must take appropriate action, to the extent possible within the Service's authorities and available resources, to manage or constrain the use to minimize impacts.

Impairment decisions need to be made in the appropriate context. This means considering the proposed action and its effects on air quality and other resources in light of the purposes for which the park was established, the management objectives, and desired conditions. The manager should also consider existing conditions of air quality and air pollution sensitive resources in the park, the relative impacts from activities within and outside the park, and the incremental increase to the cumulative effects from proposed and ongoing activities. When deciding whether



Lake sediment sampling at Sleeping Bear Dunes National Lakeshore, Michigan. Diatoms in sediments can be used to develop critical loads for air pollution.
Credit: National Park Service.

impacts from internal projects might constitute an impairment, park managers should remain cognizant of the effect such decisions might have on their ability to protect park resources and values from impacts caused by activities outside park boundaries.

3.2. Air Quality Analysis Under NEPA

The National Environmental Policy Act (NEPA) of 1969 requires federal agencies, including the NPS, to assess the impact of proposals on the quality of the human environment. The *DO-12 Conservation Planning, Environmental Impact Analysis, and Decision-Making* (NPS NEPA Handbook) indicates that the impact assessment should lay out a methodology for assessing each impact topic, including the criteria or thresholds used to draw a conclusion on the context, intensity, and duration of the impact. Based on these assessments, impacts may be characterized as "negligible," "minor," "moderate," or "major." These impact characterizations, in turn, provide a foundation for assessing whether or not the impact is likely to result in an impairment of park resources or values. Although impairment determinations are made under the Organic Act rather than as a NEPA requirement, NPS policy is to make impairment determinations concurrent with the environmental planning and assessment process of NEPA. Section 1.4.7 of the NPS Management Policies directs decision-makers to "consider any environmental assessments or environmental impact statements required by NEPA; relevant scientific studies and other sources of information; and public comments" in making impairment determinations.

The NPS has specific responsibilities for determining whether impairment of park resources would result from any action under NEPA. The NPS Environmental Quality Division (EQD) has developed the *Interim Guidance for Impairment Determinations in NPS NEPA Documents* (July 2010) which describes the process park managers should follow to assess and document impairment determinations resulting from in-park and outside-of-park activities. While this *Technical Guidance on Assessing Impacts to Air Quality in NEPA and Planning Documents* provides some general background on impairment as context for utilizing air quality information in making impairment determinations; NPS EQD's current or future guidance should be considered primary in outlining the process NPS managers should use in making impairment determinations .

In the following sections, this air quality technical guidance tracks the NPS NEPA Handbook approach by laying out methodologies, criteria, and threshold levels for characterizing impacts along a sliding scale ("negligible" to "major"). It does not specify the impact level that might constitute an impairment; however it does outline important factors to consider that may assist NPS managers in evaluating whether an impact is more or less likely to be an impairment. Impact levels/thresholds are used to identify and evaluate the resource impacts of the action in the NEPA analyses, and they also assist in defining the nature and severity of the impacts.

In addition to considering air quality impacts for internal NPS projects, there are also many federal actions that occur outside of National Park System boundaries which can have a significant effect on the air quality or Air Quality Related Values in parks. To the extent practical, superintendents and NPS staff should be engaged in external planning processes and work with agencies and partners to minimize the effects to air quality and Air Quality Related Values within parks.

While NEPA documents disclosing air quality impacts are prepared largely by technical staff and contractors, determination of whether an impact constitutes an impairment should only be made in consultation with the park manager or other NPS decision-maker. Ultimately, park managers will need to determine whether or not the impact is the "unavoidable result, which cannot reasonably be further mitigated, of an action necessary to preserve or restore the integrity of park resources or values." If the effects to park resources are the result of another agency's decision outside of NPS jurisdiction and control, the superintendent, in consultation with resource managers, should first determine whether the impacts constitute impairment or are unacceptable. Then to the extent practicable, superintendents should consult and work with the lead agency to mitigate or eliminate any adverse effects.

Considering "connected," "cumulative," "similar," and "reasonably foreseeable future" actions (CEQ NEPA Regulations: Section 1508.25) is particularly important when conducting NEPA analyses for air quality, because air pollutants can easily cross park boundaries and impacts from all sources can easily aggregate. The CEQ regulations provide specific guidance on assessing the scope of a project to determine when the impacts of actions must be analyzed together.

Further, for NEPA projects that could result in air quality effects in a National Park System unit, the NPS should be a cooperating agency in accordance with DOI regulations, 40 CFR 1501.6. The lead agency should "use the proposals and environmental analysis" of agencies with "special expertise or legal jurisdiction" to the extent possible. Wherever possible, the NPS should encourage other agencies and their stakeholders to adequately evaluate and consider air quality effects and impacts in the parks and where necessary, implement adequate mitigation measures.

Despite having different requirements and outcomes, both NEPA and the CAA PSD program provide for the assessment and evaluation of environmental effects, as well as requirements for evaluating the "severity" of those effects. A detailed description of the methods and background for air quality assessments that can be used in both PSD and NEPA is found in the found in the FLAG document, the FLM's air quality guidance document (FLAG 2010).

4. Impact Assessments and Impairment of Human Health, Visibility, and Natural Resources from Air Pollutants

4.1. Air Quality Background

Many resources and values of the National Park System are affected by air pollution. For example, the ability to appreciate scenic vistas is highly dependent on clean, clear air. Poor visibility caused by air pollution suggests that there may be other impacts occurring to resources that are not readily apparent. Air pollution may cause or exacerbate respiratory symptoms for visitors and employees at NPS areas. Human-made pollution can also injure trees and other plants or animals, acidify streams and lakes, and leach nutrients from soils.

Air pollutants emitted in and near parks may affect visibility (nitrogen oxides, sulfur oxides, and particulates); human health (hydrocarbons, ozone precursors, nitrogen oxides, sulfur dioxide, particulates, and air toxics); and ecosystems (ozone, acidic deposition of nitrogen and sulfur, nitrogen nutrient enrichment and air toxics). When air pollution concentrations and effects from a project are quantified and assessed it is important early on to identify mitigation measures, and assess strategies for potential emissions reductions. This is consistent with NPS policy to "seek to perpetuate the best possible air quality in parks," and consistent with the way NPS addresses impacts of sources located outside park boundaries by promoting the use of "best available control technology" (BACT) or the most effective emissions reductions feasible.

Point sources (industrial), area sources (oil and gas development, vehicles, agricultural, urban), and mobile sources (on and off road vehicles, ships) produce air pollution emissions that can be transported hundreds of miles into parks. Therefore, air pollution effects on resources, visitor enjoyment, and human health almost always have cumulative, as well as project-specific, impacts to consider. The existing impact of air pollutants on parks will have bearing on impact assessments and impairment determinations from a proposed project in several ways. For example, (1) if the air quality is very clean, the characteristics of visibility are such that it would only take a very small amount of pollution to create visibility degradation perceptible to the human eye; (2) if acidic deposition impacts have been occurring for several years, ecosystem tolerances may be at or above critical load levels so that even small amounts of additional emissions may cause significant ecosystem changes; (3) if air pollution concentrations in parks exceed or are close to exceeding any NAAQS, federal law (and NPS policy) may prohibit additional emissions that would increase these pollution concentrations.

4.2. Assessing Air Quality Impacts

Although there are no standard methodologies that can be applied to determine impacts or impairment in every situation, in general there are a number of tasks that will be useful for assessing impacts to parks:



A scientist uses a grid plot to monitor alpine vegetation at Logan Pass in Glacier National Park, Montana. Studies such as these have been used to develop critical loads of nitrogen deposition for sensitive alpine plants.
Credit: National Park Service.

- Determine the level of air quality analysis necessary, based on the type and amount of project emissions (Table 1), distance of project to the park, current air quality conditions in the park, and other relevant information.
- Obtain air quality information from appropriate data sources (Table 3).
- Assess impacts on air quality, human health, and Air Quality Related Values in the NEPA context (Tables 4–5).

These tasks are fairly interdependent and may be iterative, as some of the same information that can be used to determine the necessary level of analysis can also be used to interpret the severity of the effects. Each of these tasks is described in detail below.

4.2.1. Determine the Level of Analysis

The level of air quality analyses needed for the proposed action can range from a simple qualitative discussion of potential air quality impacts and emissions calculations, which may be conducted by park staff, to the use of a regional photochemical grid model, best conducted by an air quality modeling specialist (often a contracted consultant). The following actions may be useful in determining the appropriate level of analysis:

- Estimate the emissions from the proposed action and its alternatives.
- Determine the distance (in km) of the project to the park unit(s) of concern (applicable only to projects external to National Park System boundaries).

- Describe/quantify the current air quality condition in the park. For example, based on data from on-site or nearby monitors, how close is the ambient air quality to exceeding the NAAQS? Is the project located in a nonattainment or maintenance area, therefore requiring a "conformity determination?" Are there nearby sources of pollutants that will need to be accounted for in a cumulative analysis?
- Describe the types of pollutants (such as SO_2, O_3, NO_x, $PM_{2.5}$) that will be emitted, and relate them to the air quality issues of concern, such as visibility impairment or deposition.

The emissions analysis screening thresholds presented in Table 1 are intended to be used in context with other information relevant to the park (e.g., projects with relatively low emissions may sometimes warrant a more quantitative or complex level of analysis than shown in the table). However, Table 1 is intended as a first cut for projects to determine the appropriate level of air quality impact analysis in attainment areas (analysis for nonattainment areas is discussed in more detail below). Both emission quantity and duration should be considered in determining the level of analysis needed. If the project is likely to result in a small amount of emissions (< 50 tons per year [TPY]), then no air quality modeling may be necessary, and a simple description of the emissions calculations methods may be sufficient. If the project results in emissions levels > 50 TPY, additional air quality modeling should be considered. In circumstances where the project or proposed action is likely to result in high levels of emissions (> 250 TPY), more complex air quality modeling will be needed in most cases. The emissions analysis thresholds should be used only in the context of current air quality and applicable connected or cumulative actions. For example if a project is occurring in or near an area where the ambient concentrations are close (> 80%) to exceeding the NAAQS, modeling should be considered to determine if the project is likely to contribute to a NAAQS exceedance. Note that significant contribution to an existing NAAQS exceedance by emissions from a new federal project would not be allowed under the General Conformity Rule under the Clean Air Act. If the project is in a nonattainment area, emissions are restricted to a much greater extent, and would generally not be considered "negligible" unless they constitute a net decrease. In nonattainment areas, emissions are not permitted to increase above "de minimus" levels (Table 3 lists where to find more information about conformity and de minimus levels).

Table 1. Emission analysis screening thresholds for attainment areas
(Emissions categories are loosely based on EPA's Prevention of Significant Deterioration (PSD) air pollution permitting thresholds)

AQ analysis level	Proposed action (emissions)	Emissions duration
Qualitative description may be sufficient.	< 50 tons per year (TPY) (any pollutant)	One to several days or very low daily emissions over an annual period.
Screening modeling may be needed.	> 50 and <100 TPY (any pollutant)	Several days to weeks or very low daily emissions over an annual period.
Near-field or long-range transport modeling may be needed.	> 100 TPY (any pollutant)	Several weeks to months.
Complex air quality modeling is likely needed.	> 250 TPY (any pollutant)	Long term, one year to several years.

There are various air quality emissions, atmospheric transport, visibility, and pollution dispersion models available and each model varies in degree of complexity and information needs. Examples of types of modeling and analysis tools from the least complex and resource intensive to the most sophisticated and resource intensive are:

- Emissions Calculations (e.g., AP-42; MOBILE 6; forestry fuel loading and fuel consumption models such as CONSUME, FOFEM, FEPS, E&P Tank, etc.),
- Screening and near-field dispersion models (e.g., VISCREEN, AERMOD),
- Long-range transport models (e.g., CALPUFF), and
- Photochemical Grid Models (e.g., CAMx, CMAQ).

Simple emissions calculations can be used to estimate emissions from certain activities. Air quality models use emissions calculations, as well as meteorological inputs, to predict resulting air pollutant concentrations. Air quality modeling can also provide useful information about potential magnitude, duration, and location of air pollutants. Since air quality standards are generally expressed as concentrations, air quality modeling results can be used to evaluate impacts on NAAQS, potential effects to human health, or increments for criteria pollutants (an increment is the additional, cumulative amount of pollution from all new sources allowed by the PSD program in a Class I or II area). The specific air quality issues (such as visibility or deposition or ozone effects) and type and magnitude of potential emissions should be considered when selecting an air quality model.

In addition to using Table 1 as a guide for the type of air quality analysis recommended for in-park projects, a quick screening process is available to determine when external projects (originating outside NPS lands) may be exempted from further air quality analysis. The Federal Land Managers' Air Quality Related Values Work Group (FLAG) developed a screening calculation to identify projects that can be excused from additional analyses either because of their low emissions levels or their distance from a park. This screening tool is based specifically on visibility impairing pollutants and is known as the "Q/d Screen." "Q" is the sum of the visibility impairing pollutants emitted in tons per year, divided by "d" the distance from the project to the park in kilometers. If the Q/d is ≤ 10, the project is unlikely to result in significant visibility or deposition concerns. If the Q/d is >

10, a visibility and/or deposition analysis should be performed. Details of the approach are outlined in the revised FLAG guidance (FLAG 2010).

For both in-park and external projects where emissions may be small or intermittent, it is important to note that air quality analysis may still be needed for "connected," "cumulative," and/or "reasonably foreseeable future" actions. Screening out an individual project in no way removes the obligation to consider its emissions or conduct a detailed cumulative air quality analysis where necessary. In other words, it is not appropriate to segment numerous similar actions which individually may not cause air quality concerns and could be "screened" from analysis, but cumulatively may result in significant regional effects in the airshed.

The magnitude of emissions should be calculated for any project, unless it is anticipated that a project will not result in emissions of any air pollutant, or emissions will be very small (e.g., < 5 TPY in an attainment area). A few examples of types and amounts of emissions from pollution sources commonly found within National Park System units are provided in Table 2. Actual emissions for each of these types of activities will vary considerably depending on the details of the activity.

Emissions for a variety of park activities can easily be calculated using the references listed in Table 3. If the results of the emissions calculations demonstrate that more information is needed, or there are complex air quality issues in the region or project area, then additional air quality analyses should be considered. The types of pollutants that will be emitted, the distance to the receptors/park(s) of concern, magnitude of these emissions and current air quality conditions can assist in determining the type of analysis necessary. For instance, if visibility impairing (or precursor) pollutants will be emitted (SO_4, PM_{10}, $PM_{2.5}$, NO_x, SO_2) at levels above 50 TPY, or at lower levels but where visibility is a particular concern, then a screening or dispersion model that can simulate visibility effects should be considered (e.g., VISCREEN or CALPUFF). If ozone is a significant concern in the region, and ozone precursor pollutants (NO_x and volatile organic compounds [VOCs]) will be emitted from the project, a photochemical grid model (currently the only type of model that can simulate ozone production) should be considered.

Each decision for the appropriate analysis tool should be bounded by the duration, timing and frequency of the anticipated impacts. In other words, are the impacts anticipated to last only a number of hours or days, or will they continue for several months to years? What time of year will the impacts occur; will they coincide with times of high visitor use? A more extensive, but not exhaustive list of these tools is provided under "Information Needs" in Table 3. Finally, more detailed information on the types of models that should be used for air quality assessments, how they should be used and when they should be applied can be found in the FLAG 2010 guidance document and applicable EPA modeling guidance (such as the Interagency Workgroup on Air Quality Modeling [IWAQM]). In any analysis, it is important to document the data sources and rationale for the type of analysis that was selected.

4.2.2. Obtain Air Quality Information

There are many excellent sources of information available for estimating project emissions, selecting the types of air analysis tools that will be used, understanding existing air quality conditions, and assessing impacts of a project on human health and AQRVs in specific National Park System units. Table 3 lists many of these information sources, along with links to relevant web sites.

4.2.3. Assess Impact Levels

The final task is to evaluate or interpret the level of effects. The four impact categories "negligible, minor, moderate, and major" are discussed below in two parts; (1) Assessing Impacts Based on Human Health and (2) Assessing Impacts to Air Quality Related Values.

Table 2. Examples of emissions levels calculated for selected activities in parks (for the year 2000)

Park	Activity	Park-wide emissions (tons per year)
Mesa Verde	Visitor Vehicles	49 TPY PM_{10} 35 TPY VOC 26 TPY NO_x
Yosemite	Campfires	6.5 TPY PM_{10} 7 TPY VOC 1.5 TPY NO_x
Golden Gate	Watercraft exhaust	8 TPY PM_{10} 13.5 TPY VOC 165 TPY NO_x 7 TPY SO_2
Grand Canyon	Aircraft	17 TPY PM_{10} 69 TPY VOC 84 TPY NO_x 6.5 TPY SO_2
Channel Islands	Generators	0.8 TPY PM_{10} 0.9 TPY VOC 11 TPY NO_x 0.7 TPY SO_2
Redwood	Prescribed Fire	125 TPY PM_{10} 29.6 TPY VOC 2.2 TPY NO_x

Table 3. Air quality information sources		
Assessment component	**Information needs**	**Sources of information**
Air pollution emissions, regulations, and atmospheric transport	Calculated air pollutant emissions from the proposed project and cumulative emissions from other sources contributing to impacts on park resources. This requires information on current and proposed activity levels within the park. Options and data needs for air quality modeling. Information about applicable Federal, state, and local regulations including emissions limits, performance standards or management practices and permitting requirements. National Ambient Air Quality Standards (NAAQS), and General Conformity de minimus levels.	Check with NPS-ARD for information on how to calculate project emissions, to determine which cumulative sources should be included, or whether modeling is recommended. Check with local and state air permitting authorities for current emissions levels of adjacent sources, and for non-attainment area boundaries. EPA emission factors AP-42: http://www.epa.gov/ttn/chief/ap42/index.html. EPA monitoring and air emissions data: http://www.epa.gov/air/data/index.html. USFS/SAMI/VISTAS emissions tool: http://webcam.srs.fs.fed.us/emissions/. Park records may include information about activity levels (e.g., the number of visitors using personal water crafts, the number of vehicles entering the park per day). Emissions inventories for certain parks: http://www.nature.nps.gov/air/AQBasics/sources.cfm#parks and http://www.nps.gov/climatefriendlyparks/. In-park emissions can be estimated using the CLIP (Climate Leadership in Parks) tool: http://www.nps.gov/climatefriendlyparks/. FLAG (Federal Land Managers' Air Quality Related Values Work Group) Guidance on air quality modeling and analyses: http://www.nature.nps.gov/air/permits/flag/index.cfm NAAQS table: http://www.epa.gov/air/criteria.html. Many fire emissions calculation tools are available through the Fire and Environmental Research Applications Team (FERA) website: http://www.fs.fed.us/pnw/fera/publications/index.shtml EPA General Conformity de minimus levels:
Air chemistry and deposition	Ambient air quality data (O_3, PM, SO_2, NO_x) Atmospheric deposition data. Air toxics data.	EPA, state, local, or park ambient monitoring equipment for air quality data. National Atmospheric Deposition Program (NADP) for wet deposition: http://nadp.sws.uiuc.edu/. EPA-Clean Air Status and Trends Network (CASTNet) for dry deposition: http://www.epa.gov/castnet/. Park specific air chemistry and deposition: http://www.nature.nps.gov/air/monitoring/index.cfm. For parks without on-site monitors, interpolated data: http://www.nature.nps.gov/air/Maps/AirAtlas/index. Mercury Deposition Network (MDN) for mercury deposition: http://nadp.sws.uiuc.edu/mdn/. Air toxics: http://www.epa.gov/ttn/atw/index.html.
Air pollution impacts on human health	Current and future air quality levels relative to the NAAQS to help assess health impacts to visitors and employees. Air Quality Index scores by state and county to assess health impacts of current and cumulative air quality conditions.	Ozone NAAQS exceedances in parks: http://www.nature.nps.gov/air/Monitoring/exceed.cfm. Ozone health advisories in parks: http://www.nature.nps.gov/air/data/O3AdvisSum.cfm. EPA Air Quality Index for interpreting human health impacts: http://airnow.gov/index.cfm?action=static.aqi http://www.airsis.com/usfs/aqi.asp.
Air pollution impacts on natural resources (AQRVs)	Current condition and future projected condition related to air quality impacts on park AQRVs (visibility, flora, fauna, soils, water or cultural resources). This may include information on resources highly sensitive to air pollution impacts, as well as documented current impacts. Visibility trends, natural background visibility, current condition, and historic conditions. Visibility impacts from particulate matter, nitrogen oxides and sulfur dioxides. Vegetation impacts from ozone. Deposition sensitive aquatic ecosystems (water and aquatic biota).	AQRV data available from NPS-ARD, scientific literature and reports, Inventory and Monitoring (I&M) Networks: http://www.nature.nps.gov/air/permits/aris/index.cfm. Visibility Information Exchange Web System (VIEWS) for visibility photos; transmissometer or nephelometer data; fine and coarse mass from particle filters. Ozone risk assessment for vegetation: http://www.nature.nps.gov/air/permits/aris/networks/ozonerisk.cfm. Water quality in parks: http://www.nature.nps.gov/water/infodata.cfm.

4.3. Assessing Impacts to Human Health

Air quality impacts to human health occur from all pollutants cumulatively. Therefore, when assessing whether the impact levels are negligible, minor, moderate, or major, current air quality conditions need to be considered along with the estimated project-specific changes in air quality. The National Ambient Air Quality Standards (NAAQS) have been developed primarily to protect human health from air pollutants to the same degree nationwide. However, concentrations below the NAAQS can also affect human health, particularly in sensitive individuals, and disclosure of these impacts is important. Air quality modeling, as discussed in the previous section, can be used to develop quantitative estimates to better assess how the proposed project emissions, in combination with existing air quality conditions, may impact human health.

The EPA has developed an Air Quality Index (AQI) that correlates criteria pollutant concentrations to associated health concern categories. NPS recommended cumulative impact levels for assessing human health concerns in planning processes are found in Table 4. Impact levels in this table are based on a combination of the AQI ranges established by EPA, and NAAQS thresholds. The AQI index is widely used by EPA to communicate air quality conditions to the public. The scale is non-linear in the upper numbers and the concentration at which the NAAQS is reached is always an AQI of 100 (unhealthy for sensitive groups). According to the AQI, concentrations below 50% of the NAAQS represent "Good" air quality and concentrations between 50% and 99% of the NAAQS represent "Moderate" air quality.

4.3.1. Health Effects Thresholds

In Table 4, the "Negligible" level is the range of concentrations for each pollutant that is the highest estimated policy relevant background (PRB) concentration as determined by EPA in its criteria pollutant documents and pollutant assessments. Concentrations in this range are indistinguishable from variations in the background concentrations that are of natural and long-range transport origin. Some National Park System units maintain air quality in this background range most of the time. The source for background concentrations is EPA's Integrated Science Assessment documents for each pollutant (http://www.epa.gov/ttn/naaqs/). The PRB represents what is currently thought to be the natural background plus human pollution transported from outside of North America. The "Minor" level follows the AQI scale and corresponds to concentrations from the PRB up to an additional 50% of the difference between the PRB and the NAAQS. The "Moderate" level is from 51% to 99% of the NAAQS. The "Major" level in Table 4 corresponds to the NAAQS for each pollutant. Pollutant concentrations at or above the NAAQS describe "nonattainment" status and represents unhealthy air quality for park visitors and employees. The formal process for state and federal air regulatory agencies to designate an area as nonattainment for the NAAQS is complex (e.g., 98% or 99% of the available data surpasses these levels in 2–4 instances over a three year period; where the specific criteria varies by pollutant). For the impact levels discussed here, NPS recommends a simplified scheme that can be applied across all impact categories, for all pollutants: compare the 99th percentile of the monitored or modeled air concentration data available for each pollutant in (or representative of) the park over the most recent 3-year period to the values in Table 4. Data representing "exceptional events" (e.g., fire) need not be included, and if less than three years of data are available then the most recent year can be used instead. Consultation with NPS-ARD staff regarding how to apply this process to a specific case is always recommended.

Table 4. Assessing cumulative impacts to human health
(Concentrations are expressed in ppm or µg/m^3 following the practice by EPA)

Impact level	8-hr Ozone* (ppm)	8-hr Carbon Monoxide (ppm)	1-hr Sulfur Dioxide (ppm)	24-hr PM_{10} (µg/m^3)	24-hr $PM_{2.5}$ (µg/m^3)	1-hr Nitrogen Dioxide (ppm)
Negligible	0–0.045	0–0.2	0–0.001	0–11	0–5	0–0.001
Minor	0.046–0.064	0.3–4.4	0.002–0.034	12–77	6–15	0.002–0.049
Moderate	0.065–0.075	4.5–9.0	0.035–0.074	78–155	16–34	0.050–0.099
Major	> 0.075	> 9.0	≥ 0.075	> 155	≥ 35	≥ 0.100

* In January 2010, EPA proposed strengthening the ozone NAAQS to a value between 0.060–0.070 ppm. EPA is expected to finalize the rule in December 2010. At that time, the ozone concentrations designating impact levels will need to be adjusted.

4.4. Assessing Impacts to Air Quality Related Values (visibility, flora, fauna, soils, water) from Airborne Pollutants

As discussed earlier, air pollution regulatory standards, such as the NAAQS, do not protect natural resources or visibility from air pollution impacts. However, there are other air quality and resource-based thresholds that can be used to assess these potential impacts.

In many cases, the degree to which air pollution is currently affecting park resources will dictate the amount of additional air pollution that can be added before impact or "impairment" to park resources occurs. In the case of visibility, a very clean current condition means that a small amount of added air pollution emissions could produce a perceptible visual impact. With atmospheric deposition, a high amount of current deposition (relative to natural background deposition levels) increases the likelihood that additional deposition from new emissions would contribute to cumulative resource impacts in the soils, waters, and vegetation. Because parks and ecosystems are so diverse, there are no "one size fits all" quantitative measures for determining impact levels, therefore the information below provides more general guidelines rather than hard and fast rules.

The recommended AQRV-based impact levels in Table 5 utilize a variety of qualitative and quantitative measures based on published data, policy, and professional judgment. The bullets under each of the four impact levels describe:

- examples of potential predicted impacts from the **proposed action and/or cumulative actions** to natural resources (e.g., exceedance of deposition significance thresholds , or visibility impact thresholds), and
- **current air quality conditions** in the park (e.g., W126 ozone concentrations, annual wet deposition averages, annual visibility averages or other cumulative thresholds) at each impact level that may increase the likelihood of harm to park resources from additional emissions.

The examples provided are not necessarily comprehensive or expected to occur to all resources simultaneously in order t o merit designation at an impact level. Impact levels selected for proposed or cumulative actions may differ between parks and projects depending on the existing (current baseline) air quality condition and existing impacts to natural resources.

For visibility analyses, it is important to note that the FLAG thresholds should be applied using estimated natural background visibility conditions rather than current conditions, as this is consistent with national policy goals for visibility improvement.



Field technicians collect plant specimens for nutrient analysis to assess the effects of nitrogen deposition in Great Smoky Mountains National Park
Credit: National Park Service, 2008.

Table 5. Assessing impacts of proposed and cumulative actions to air quality and AQRVs

Negligible Impacts

Examples of predicted Impact:	Current Air Quality Condition:
▪ No perceptible visibility impacts likely (no visible smoke, plume, or haze). ▪ Predicted (i.e., modeled) visibility impacts, and nitrogen and sulfur deposition loading levels are below thresholds listed in NPS FLAG and Deposition Analysis Threshold (DAT) guidance.	▪ Ozone W126* ≤ 7ppm-hrs or SUM06** ≤ 8 ppm-hrs ▪ Wet deposition < 1 kg/ha/yr for both nitrogen and sulfur ▪ Visibility† no more than 2dv above natural background condition

Minor Impacts

Examples of predicted Impact:	Current Air Quality Condition:
▪ Predicted (i.e., modeled) visibility impacts and nitrogen and sulfur deposition loading levels are approaching (between 90–100%) of thresholds listed in NPS FLAG and DAT guidance. ▪ Perceptible visibility impacts occur, but are only visible from a small area of the park, are of short duration (less than one day per year) and visible to only a few park visitors on the days that they occur.	▪ Ozone W126* ≤ 7ppm-hrs or SUM06** ≤ 8 ppm-hrs ▪ Wet deposition < 1 kg/ha/yr for both nitrogen and sulfur ▪ Visibility† no more than 2 dv above natural background condition

Moderate Impacts

Examples of predicted Impact:	Current Air Quality Condition:
▪ Predicted (i.e., modeled) visibility impacts exceed thresholds listed in NPS FLAG guidance, but perceptible impacts are minimal (see next bullet); and/or nitrogen and sulfur deposition loading levels exceed screening thresholds in the DAT guidance but available scientific information indicates deposition will not, or is not, harming integrity of the resources in the park. ▪ Perceptible visibility impacts occur and are visible from several areas of the park, occur between one and several days per year, and many park visitors may observe them on the days that they occur. Note: impacts that exceed the FLAG thresholds may still constitute a "Major" impact regardless of current condition, taking into account the magnitude, frequency and duration of the impact, as described in the FLAG document.‡	▪ Ozone W126* from 7–13 ppm-hrs or SUM06** ozone 8–15 ppm-hrs ▪ Wet deposition is from 1–3 kg/ha/yr for both nitrogen and sulfur, and sensitive ecosystems are present in the park that could likely be impacted in some way (change to physical, chemical or biological processes) from deposition ▪ Visibility† from 2–8 dv above natural background condition

Major Impacts

Examples of predicted Impact:	Current Air Quality Condition:
▪ Predicted (i.e., modeled) visibility impacts exceed thresholds listed in NPS FLAG guidance (see next bullet); and/or nitrogen and sulfur deposition loading levels exceed screening thresholds listed in NPS DAT guidance, and available scientific information indicates that deposition may harm the integrity of resources in the park. ▪ Perceptible visibility impacts occur and are visible from many areas of the park, occur many days over the course of a year, or are visible to a majority of park visitors on the days that they occur. Note: impacts that exceed the FLAG thresholds may still constitute a "Major" impact regardless of current condition, taking into account the magnitude, frequency and duration of the impact, as described in the FLAG document.‡	▪ Ozone W126* > 13 ppm-hrs or SUM06** > 15 ppm-hrs ▪ Wet deposition > 3 kg/ha/yr for either nitrogen or sulfur or deposition impacts to AQRVs have been documented in the park ▪ Visibility† greater than 8 dv above natural background condition ▪ Visibility conditions are worsening (trending downward based on ARD's 10 yr trends info) at the park

* The W126 preferentially weights the higher ozone concentrations most likely to affect plants and sums all weighted concentrations during daylight hours over three months during the growing season, giving a cumulative metric expressed in ppm-hrs.
** The SUM06 sums all hourly ozone concentrations ≥ 0.060 ppm during the daylight hours over three months during the growing season, giving a cumulative metric expressed in ppm-hrs.
† Visibility condition = Group 50 visibility - annual average natural conditions, where Group 50 is the mean of the 40th–60th percentiles of observed conditions in deciview (dv).
‡ It is important to note that the FLAG thresholds should be applied using estimated natural background visibility conditions rather than current conditions, as this is consistent with national policy goals for visibility improvement. For the purposes of this guidance, the current condition information is used only as a "modifier" to determine whether more weight should be given to modeled impacts predicted in the moderate or minor category in parks where current condition is worsening.

4.4.1. Ozone Effects Thresholds

Ozone effects thresholds are based on information from EPA's recent review of the ozone standards. EPA recognized that plants respond to cumulative ozone exposures rather than short-term concentrations. Cumulative exposures can be expressed as either the W126 or the SUM06, defined in Table 5. EPA has considered the recommendations from an expert workgroup who noted that for growth effects to tree seedlings in natural forest stands, a W126 range of 7–13 ppm-hrs would be protective; a W126 of 5–9 ppm-hrs, would protect plants in natural ecosystems against foliar injury (Heck and Cowling 1997; EPA 2007). Therefore, NPS considers that W126 exposures ≤7 ppm-hrs represent a minor impact to ozone-sensitive vegetation, while W126 exposures > 13 ppm-hrs represent a major impact. Equivalent SUM06 exposures from Table 5 may also be used to evaluate impact levels.

4.4.2. Deposition Impacts Thresholds

Nitrogen (N) and sulfur (S) deposition can cause acidification of lakes, streams, and soils; N deposition can also cause fertilization and eutrophication, leading to unwanted changes in species abundance, composition and a loss of biodiversity. Several factors are considered in evaluating the potential for deposition impacts from a proposed project, including natural background deposition estimates and available information on deposition effects on ecosystems. Estimates of natural background deposition for total deposition are approximately 0.25–0.50 kilograms per hectare per year (kg/ha/yr) for N or S (Bates et al. 1992; Galloway et al. 1995; Galloway et al. 1982; Holland et al. 1999). For wet deposition only, this is roughly equivalent to 0.13–0.25 kg/ha/yr. Certain sensitive ecosystems respond to very low levels of deposition (e.g., 3 kg/ha/yr total deposition, or about 1.5 kg/ha/yr wet deposition) (Baron 2006). "Critical loads" is a term used to describe the amount of deposition below which ecosystems are protected from harm, according to current knowledge. An overview of the current research on empirical nitrogen critical loads for most U.S. ecosystems is in Pardo et al. 2010.

Evidence is not currently available that indicates that wet deposition amounts less than 1 kg/ha/yr for either N or S cause ecosystem harm. Therefore, if current baseline wet deposition of N or S < 1 kg/ha/yr, *and* the proposed project's predicted contribution to deposition is below the screening thresholds indentified in the DAT guidance, the impact to deposition-sensitive resources is likely to be negligible. If current wet deposition of N or S is > 3 kg/ha/yr, or applicable critical loads values or other scientific information is available that suggests the ecosystem is being harmed by current deposition levels, *and* the proposed project's contribution to deposition is above the DAT screening levels, the impact is likely to be moderate or major. It is important to remember that the DATs only represent significance thresholds, below which the amount of deposition is considered "insignificant," rather than any indication that there will be impact to resources. Therefore, an exceedance of the DAT indicates only that deposition to the park may be of concern, and predicted or modeled deposition increases should be considered in the context of their magnitude and intensity, as well as current knowledge regarding the sensitivity of the ecosystem and resources of concern, including any documented deposition impacts that are already or reasonably believed to be occurring. This guidance is consistent with the criteria and methodology used by the NPS to evaluate progress toward air quality performance goals in the NPS annual report to Congress, as well as decision making criteria for impacts to AQRVs identified in the FLAG 2010 guidance.

4.4.3. Visibility Impacts Thresholds

Potential impacts to visibility take into account current conditions and predicted changes to visibility. Visibility can be expressed in terms of visual range (units of length e.g. kilometers), light extinction (units of inverse length e.g. inverse megameters [Mm^{-1}]), or haze index (deciview [dv]). The terms are mathematically related. If the current average light extinction is no more than 2 dv greater than estimated natural conditions and changes to visibility from the proposed project (and /or cumulative sources) are less than the thresholds given in the FLAG guidance, the impact is likely to be negligible. If current visibility condition is more than 8 dv higher than the estimated natural conditions *or* changes to visibility from the proposed project (and /or cumulative sources) exceed the thresholds[1] given in the FLAG guidance, then visibility is degraded in the park, and the additional impact is more likely to be major. This guidance is consistent with the criteria and methodology used by the NPS to evaluate progress toward air quality performance goals in the NPS *Air Quality in National Parks: Annual Performance and Progress Report* (Annual Report) and the FLAG 2010 guidance.

4.5. Impairment Considerations

If a potential adverse impact were identified from the impact categories above, then the park's enabling legislation and management objectives (relative to resource protection, human health, and the opportunity for visitors to view scenic vistas) could be considered by the park superintendent in making a final impairment determination. The following questions are useful for NPS managers to consider in making impairment determinations.

- Are projected air quality concentrations likely to adversely affect visitor or employee health? Note, if air quality concentrations are projected to significantly contribute to a violation of the NAAQS, or impede the States' progress towards achieving the NAAQS, the action cannot be approved without mitigations or offsets.
- Are human-caused emissions in/near a park likely to adversely affect visibility conditions such that they detract from the view of scenic vistas? Where very clean air quality conditions exist for the "best visibility days"

1. It is important to note that the FLAG thresholds should be applied using estimated natural background visibility conditions rather than current conditions, as this is consistent with national policy goals for visibility improvement.

in a park, a small addition in emissions may be more likely to result in perceptible changes in visibility.

- Are human-caused emissions likely to create a visible smoke, haze, or plume?
- Are human-caused emissions in/near a park likely to create adverse impacts to resources/values that are: specifically mentioned in enabling legislation, key to natural or cultural integrity or opportunities for enjoyment of park, identified in the park General Management Plan or other planning document, or are AQRVs in Class I areas or wilderness areas?
- Are projected resource impacts above air-quality "concern thresholds" for visibility, nitrogen or sulfur deposition (as posted on the NPS-ARD web site in the FLAG or DAT guidance documents)?
- Are projected increases in emissions likely to exacerbate current stresses from air pollution on visibility, flora, fauna, soil, or water (e.g., exceeds critical loads)?



A scientist in Sequoia National Park studies physiological responses of pine trees to ozone.
Credit: Jeanne Panek, 2003.

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National Park Service
U.S. Department of the Interior

Natural Resource Program Center
Air Resources Division
PO Box 25287
Denver, Colorado 80225

www.nature.nps.gov/air